Laboratory Environment Safety and Health Committee
Cryogenic Safety Subcommittee

MINUTES OF MEETING 04-04

May 12, 2004

Final

Committee Members Present	**Committee Members Absent**
S. Kane	**R. Alforque**
P. Kroon	**W. Glenn**
E. Lessard (Chairperson)	**M. Rehak**
P. Mortazavi	
A. Sidi Yekhlef	
R. Travis* (Secretary)	
K. C. Wu	
R. Gill+	
N. Bernholc+	
(* non-voting, + ad hoc)	

Visitors
K. Kusche
S. Shchelkunov

Agenda:

1. **Review of the LAser driven Cyclotron AutoResonance Accelerator (LACARA) - Building 820 (ATF)**

Minutes of Meeting: Appended on pages 2 through 4.

ESH COMMITTEE MINUTES APPROVED:

_____Signature on File ___________　　　　**_______________________________**

E. Lessard	**Date**	**J. Tarpinian**	**Date**
LESHC Chairperson		**ESH&Q ALD**	

Chairperson E. Lessard called the fourth meeting of 2004 of the Laboratory Environmental Safety and Health Committee (LESHC) to order on May 12, 2004 at 1:31 p.m.

1. **Review of the LAser driven Cyclotron AutoResonance Accelerator (LACARA) - Building 820 (ATF):** E. Lessard invited S. Shchelkunov to present the Laser driven Cyclotron AutoResonance Accelerator experiment to the Committee[1].

1.1. Mr. Shchelkunov and other attendees made the following points during the course of the presentation and in response to specific Committee questions:

1.1.1.1. As described in ESR PO2004-099 [1], LACARA consists of two major parts: the laser transportation system and the solenoidal magnet. The latter component was the focus of this meeting.

1.1.2. The magnet is conductively cooled by a commercially available cryocooler from Janis and SHI. It is a dry magnet.

1.1.2.1. The cryocooler in turn consists of a compressor, a cooler head and two braided stainless steel hoses that connect these two components.

1.1.2.1.1. The system uses helium gas as the cooling medium.

1.1.2.1.2. The helium gas is pressurized at ~235 psig and cooled to 4 degrees K. He inventory under these conditions is 25.4 liters. (At room temperature and atmospheric pressure the helium inventory is 406.4 liters.)

1.1.2.2. LACARA does not use any liquefied gases.

1.1.3. The magnet will be tested in the Building 820 high bay. The test cycle is expected to require approximately 10 days and is described in the document entitled "Magnet Test" [1]. (After the test period, the LACARA experiment will be installed on ATF Beamline # 2, discussed below.)

1.1.4. There was much discussion about the inherent magnetic, cryogenic and electrical hazards associated with LACARA and how to control them, particularly during the testing period.

1.1.4.1. Unlike the experimental halls, the high bay does not have administrative or hardware access controls.

1.1.4.2. Forklifts and similar equipment are not allowed near the equipment during the test period.

1.1.4.3. Although it is expected to hold pressure for approximately a year, there is a possibility that the system will have to be periodically charged with helium. The charging is only done when the system is warm. The helium cylinder will be removed from the area upon completion of system charging.

1.1.4.3.1. The charging instructions are provided by the manufacturer. One member of the experimental team has performed the helium charging process.

1.1.5. Oxygen deficiency is not a concern based on the Committee review of the ODH calculations that were provided in the ESR form. The calculation was

---

[1] Mr. Shchelkunov's presentation, the review material provided to the Committee and these Minutes are posted on the LESHC website: http://www.rhichome.bnl.gov/AGS/Accel/SND/laboratory_environemnt,_safety_and_health_committee.htm.)

based on the volume of the experimental hall, where it was shown to be a non-ODH area. The Bldg. 820 High Bay has a much larger volume for helium mixing, so there is no ODH hazard in this area either.

1.1.6. The second phase of the project will install the LACARA experiment on ATF Beamline # 2. Installation is expected to begin in August of 2004.

1.1.6.1. This experiment will not introduce any hazards that are outside of the existing ATF SAD Envelope.

1.1.6.2. This area is interlocked to prevent access when the ATF beam is on. (There are no magnet energized interlocks.)

1.1.6.3. There was some concern about radiation hazards due to beam scatter. The ATF is shielded and accessible areas are monitored on a monthly basis. .

1.1.6.4. A magnetic “cage” may be installed to ensure that LACARA does not affect collocated experiments.

1.2. The following motions were crafted and approved by the Committee:

1.2.1. Motion No. 1 -The proposal to test the LACARA magnet in the Bldg. 820 High Bay is approved, subject to the following conditions:

1.2.1.1. Install a fence for access control during the test period. (Orange plastic snow fence is acceptable.) The fence must be located outside the 5 gauss line and enclose all of the experimental apparatus.

1.2.1.2. Mark the 5, 60 and 600 gauss lines on the high bay floor and post the required signage in accordance with the SBMS Subject Area. Please contact the Static Magnetic Fields SME (Nicole Bernholc) for additional guidance.

1.2.1.3. Revise the “Static Magnetic Fields Exposure Form” per the Subject Area and the input provided at the meeting. Provide a copy of the revised form to the Committee for review.

1.2.1.4. Post signage to control the introduction of ferrous objects (e.g. tools) into the area.

1.2.1.5. Revise the test and operating instructions to require a sweep (to be performed prior to magnet energization) for ferrous objects.

1.2.1.6. For access control purposes, post signage with points of contact (i.e., names and phone numbers) at the access gate(s).

1.2.1.7. Label the cooling lines for the cryohead in accord with ESH 1.14.0, “Identification of Piping Systems”.

1.2.1.8. Tape the cooling lines to the floor to address the potential tripping hazard.

1.2.1.9. Electrically bond and ground all equipment. Cover any exposed conductors (e.g., the current leads on the magnet hull) for personnel protection.

1.2.2. Motion No. 2 –The proposed operation of the LACARA experiment on ATF Beamline # 2 is approved, subject to the following conditions:

1.2.2.1. Implement Conditions 1.2.1.2, 1.2.1.4, 1.2.1.6 and 1.2.1.9, as appropriate for LACARA operation.

1.2.2.2. Install a "Magnet Energized" light, positioned so that it is visible from both access doors.

1.2.2.3. Kindly inform the LESHC Chairman and Secretary of the status of these operational conditions prior to the start of operations.

2. The Meeting was adjourned at 3:01 p.m.

Before using a copy of this form, verify that it is an acceptable version by checking with your Experiment Review Coordinator. Double-click to change the state of a checkbox, or type "X" over the box, or paste this ☑

EXPERIMENT SAFETY REVIEW FORM

REVIEW NUMBER (supplied by ERC): PO2004-099

PRINCIPAL INVESTIGATOR: Jay L. Hirshfield **DATE: 04/06/04**

GROUP: Omega-P Inc., and Yale University

EXT: 203-773-9061 **E-MAIL: jay.hirshfield@yale.edu** **LIFE NUMBER: X8084**

Project Title: LACARA - LAser driven Cyclotron Autoresonance Accelerator, (BNL code = AE25) BNL point of contact: Sergey Shchelkunov, ext:2505, shchelkunov@bnl.gov
Location(s): Building 820, ATF experimental hall (beamline #2) and highbay
Proposed Start Date and Duration: 4/1/04, 4 years (first proposed in 2000, on hold since)

SIGNATURES:

Principal Investigator:	**Date:**
Experiment Review Coordinator:	**Date:**
ESRC Chairman:	**Date:**
	Date:
	Date:
	Date:
	Date:
Approval **Department Chairperson:**	**Date:**
Review/Approval Comments:	
Walkthrough Signature:	**Date:**
Expiration Date (max 1 yr.):	
FUA Change Required? ☐ **Y** ☑ **N**	**Fire Rescue Run Card Changes Required?** ☐ **Y** ☑ **N**
Has a NEPA Review been Performed for this Project? ☐ **Y** ☑ **N**	
Project Termination Acceptance Signature: **Comments**	**Date:**

I. DEFINE THE SCOPE OF WORK

A. Description

Describe the experiment purpose/scope. Identify all apparatus that will be used, and associated requirements. List special equipment (X-ray generators, lasers etc.) that will be used during the project. Identify measurement and test equipment, apparatus operating conditions, and required maintenance procedures as appropriate. Include calibration frequency for formal calibration requirements. Attach supporting documents such as engineering calculations, drawings and specifications.

Indicate if modification of facility is required. Include the setup and decommissioning phases of the experiment. The Work Permit Process/Form may better address the hazards & controls of the set-up and/or tear down phases. Indicate if a Work Permit will be used.

The goal of this experiment is a proof-of-principle test of LACARA.

1) LACARA operational principle.

LACARA converts the laser beam energy into the longitudinal momentum of electrons. In essence, LACARA utilizes so-called the ExB drift, with E, and B being the electric and magnetic fields of the laser radiation. The resulting so-called ponderomotive force acting on electrons is perpendicular to both the E and B fields, and is proportional to the energy flux density. The force is pointed in the direction of the laser beam propagation, and has significant strength when one uses a tightly focused, high power laser beam. Such force could provide significant acceleration even over a short distance. An electron beam undergoing the acceleration must copropagate with the laser beam, and have some initial longitudinal momentum (the longitudinal direction and the laser beam direction of propagation, thus, are the same.)

The electrical force acting transversally pushes an electron out of the laser beam. For a tightly focused laser beam the electron would quickly leave the region where the ponderomotive force is of high values, unless one employs a mechanism to confine electrons near the line along which the laser beam propagates. In LACARA, to confine electrons a solenoidal magnetic field is used. The magnetic field axis coincides with the laser beam line of propagation.

Electrons gyrate in the magnetic field, so that to maintain the synchronism between the electrons and ponderomotive force one must employ a circularly polarized laser beam, whose omega-frequency equals to the gyro-omega frequency divided by the relativistic gamma-factor (for gammas < 250).

2) LACARA main parts/components; safety concerns.

The planned interaction point between electron bunches and the laser beam is the ATF 2nd experimental beam line (see attachment section: LACARA.bmp, BL2-side.bmp, BL2-top.bmp).

LACARA has two main parts installed by the user: the laser transportation system (LaserTransport.bmp), and the magnet (Magnet.doc). All other devices, parts, etc are provided by ATF.

Currently we are going to use 0.8 TW CO2 laser beam. It will provide an energy gain of about 20 MeV over 0.8 m for an electron bunch whose initial energy is around 50 MeV. With the ATF-planned availability of higher laser power we are expecting to prove that a gradient of 100 MeV/m could be achieved; however, that goal is beyond the scope of the work described here.

The planned acceleration gain of 20 MeV for an electron bunch with the initial energy 50 MeV results in the final energy of 70 MeV. This is below the allowable level of 75 MeV permitted to have at the ATF. Consequently, we are not considering any changes in the radiation-shielding configuration.

To deliver the CO2 laser to the 2nd beam line we are planning on installing a laser-delivery line. It will require additional vacuum pumping which is included in the design (see LaserTransport.bmp).

A solenoid magnet will be used to provide the solenoidal field. The required magnetic field strength on the solenoidal axis is 5.82 T (see FieldMap.bmp where we provide the field map for a larger inside field 5.9 T) At full operational current (5.9 T inside) the 600 Gs contour is about 0.25 m from the magnet hull, the 60

Gs contour is about 0.9 m from the hull, and 5 Gs contour is about 2.5 m from the hull (the walls of the magnet tank) We are planning on posting this information near the experiment location; marking 600, 60, and 5 Gs contours by appropriate signs; and issuing the voice notification every time the magnet is being energized. Additional controls will be established as required by the ESR Committee's review. The magnet uses a cryocooler from Janis, and SHI (a commercially available unit). This cryocooler consists of two parts: compressor, and cooler head. Two parts are connected by two hoses through which the gaseous He is pumped at 235 psig. The total compressed volume of He is 25.4 liters. Normalized to the atmospheric pressure (1 atm), and room temperature the volume is 406.4 liters. The evaluation of oxygen depletion hazard showed no hazard if the magnet is operated at the ATF experimental floor. If all of the helium gas escapes, the oxygen level drops from 21% to 20.95% (see attachment: ODH of LACARA). Consequently we are not considering any specialized protection to be designed in the case of total Helium loss.

It should be pointed out that at no time the power supply should be disconnected from the magnet. The power supply is designed to control the magnet during energizing, deenergizing, and normal mode of operation. In a case of external power failure the power supply safely brings the magnet to the zero-current. It also zeroes the replenishing current to the magnet during a quench, and locks itself so that an operator cannot restart it, unless unlocked.

3) Planned experimental steps:

a) The first step is a test of the magnet only. The total time is estimated to be around 10 days. The test is aimed to prove that after transportation the magnet is fully operational. This test is going to be done outside the ATF experimental hall. A suggested area is the high bay of bldg. 820. We would like to ask the committee to allow us the completion of the step (a) independently on the step (b). Please, see "Magnet-test.doc" in the attachment section for a detailed description of this test.

b) The second step is to assemble, and run LACARA. The location is the ATF experimental floor (ATF experimental hall). All components demonstrated in drawings (see the attachment section: BL2-side.bmp, BL2-top.bmp) will be installed and used.

B. Materials Used /Waste Generated

List materials to be used and wastes generated. Refer to the BNL Chemical Management System for a complete listing of the chemicals in your locations. Include samples, chemicals, controlled substances, gases, cryogens, radioactive materials, and biological material. You may use generic chemical class descriptions for commonly used materials (e.g., organic solvents, acids). List disposal methods. ***Denote disposal method using the codes below.***

Materials Used & Wastes Generated	**Disposal Method Type (Code below)**	**Estimated Quantity (provide units)**		**Estimated Annual Waste Generation**
		Per Use	**Total/Yr**	
NONE				

Note: Identify Age Sensitive materials or special handling requirements.

Disposal Method Codes:

Air Emissions	**Liquid Effluents**	**Wastes**
P = Point Source	**S** = Sanitary	**H** = Hazardous
F = Fugitive	**ST** = Storm water	**I** = Industrial (Non-hazardous waste e.g., oils)
	O = Other	**R** = Radioactive
		M = Mixed (Radioactive + Hazardous)
		RM = Radioactive Medical
		MW = Medical
		T = Trash

C. Waste Minimization/Pollution Prevention

Describe how you plan to minimize generation of the wastes described above, and identify pollution prevention opportunities. Consider Ordering/using the smallest amount, using recycled material substituting non-hazardous materials. The [Pollution Prevention and Waste Minimization Subject Area]() describes how to plan, conduct, and closeout work activities to eliminate or minimize the impact of their activities on the environment.

This experiment uses materials in the minimum required quantities to reduce wastes and substitutes non-hazardous materials whenever possible.

II. IDENTIFY AND ANALYZE HAZARDS ASSOCIATED WITH THE WORK

In this section indicate the hazards in each class. Include the setup and decommissioning phases of the experiment.

Physical Hazards (check all that apply)		☐ None	
☐ Cryogens	☐ Oxygen deficient atmosphere		☐ Noise > 85 dBA
☐ Fall hazards (e.g., ladders, elevated platforms, towers)			
☑ Material handling equipment (e.g., cranes, hoists, forklifts)			
☐ Machine shop or nonportable powered tools use			
☑ Electrical hazards (exposed conductors, large batteries, capacitors, etc)			
☐ Confined space		☐ Trenching/soil excavation	
☐ Extreme temperatures in workplace		☐ Remote location	
☑ Compressed gases (lecture bottles, cylinders, gas lines)			
☑ Pressurized vessels or systems			
☐ Vacuum chambers or systems with >1000 J stored energy			
☐ Autoclaves or high temperature ovens			
☐ Open flames		☐ Welding, brazing, silver soldering	
☐ Flammable gases/liquids/solids		☐ Other spark producing activity	
☐ Other (specify):			
Chemical Hazards (check all that apply)		☑ None	
☐ Carcinogens	☐ Highly acute toxins	☐ Reproductive toxins	☐ Corrosives
☐ Flammable liquids	☐ Flammable solids	☐ Strong oxidizers	☐ Oils
☐ Explosives	☐ Peroxidizables	☐ Pyrophoric materials	☐ PCBs
☐ Asbestos	☐ Pesticides/herbicides	☐ Controlled substances	
☐ Highly reactive materials		☐ Perchlorates	
☐ Storage or use of Beryllium or Beryllium articles. Attach [Beryllium Use Review Form]() if checked.			
☐ Toxic metals (e.g., As, Ba, Be, Cd, Cr, Hg, Pb, Se, Ag)			

☐ Other (specify):		
Radiation Hazards (check all that apply)	☐ None	
☐ Sealed radioactive sources	☐ Windowless radioactive sources	
☐ Dispersible radioactive materials	☐ Neutron-emitting radioactive sources	
☐ Non-fissionable radioactive materials	☐ Fissionable radionuclides	
☑ Ionizing radiation-generating devices (x-ray sources, accelerators): ATF-LINAC		
☑ Class II, IIIa, or IIIb (visible <15mW) lasers	☑ Class IIIb (nonvisible >15mW) or IV lasers	
☐ Dynamic magnetic fields >1G at 60 Hz or dynamic electric fields > 1kV/m at 60 Hz		
☐ Static magnetic fields < 5 G. No Exposure Form is required		
☐ Static magnetic fields > 5 G and < 600 G	☑ Static magnetic fields exposure. Attach Static Magnetic Fields Exposure Form when required.	
☑ Static magnetic fields ≥ 600 G		
☐ Radio frequency (RF) or Microwave sources exceeding 10 mW radiated output		
☐ Infrared sources > 10 W	☐ Ultraviolet sources > 1 W	
☐ Extremely low frequency (ELF) radio sources		
☐ Other (specify)		
Biological Hazards (check all that apply)	☑ None	
☐ Regulated etiological agent	☐ Recombinant DNA	☐ Animals
☐ Human blood/components, human tissue/body fluids		☐ Human subjects
☐ Other (specify):		
Offsite Work (check appropriate box)	☑ None	
☐ Reviewed or controlled by ES&H programs at the offsite location	☐ Requires additional controls (include in the next section)	
Security Issues Checklist (check all that apply)	☑ None	
☐ Access controls	☐ Cyber security	
☐ Classified materials or information	☐ Counter-intelligence work	
☐ Import or export controls	☐ Personnel security	
☐ Nuclear material control and accountability	☐ Valuable materials	
☐ Other (specify):		

See Identification of Significant Environmental Aspects and Impacts Subject Area or your ECR if you need assistance completing the following table.

Significant Environmental Aspects (check all that apply)	☑ None

☐ Any amount of hazardous waste generation
☐ Any amount of radioactive waste generation
☐ Any amount of mixed waste generation (radioactive hazardous waste)
☐ Any amount of transuranic waste generation
☐ Any amount of industrial waste generation (e.g., oils, vacuum pump oil)
☐ Any amount of Regulated Medical Waste
☐ Any atmospheric discharges that require engineering controls to reduce hazardous air pollutants or radioactive emissions, or are identified as a Title V emission unit, or require monitoring under NESHAP
☐ Any liquid discharges that require engineering controls to limit the quantity or concentration of the pollutant, or include radionuclides detectable at the point of discharge from the facility, or contain any of the chemicals listed on BNL's SPDES permit
☐ Storage or use of any chemicals or radioactive materials that require engineering controls – see Storage and Transfer of Hazardous and Nonhazardous Materials Subject Area
☐ On-site or off-site transportation of chemicals or dispersible radioactive materials
☐ Any use of once-through cooling water with a flow of 4 gpm – 24 hrs/day (10 gpm – 8 hrs/day, daily use of >15 gpm for >60 days) and discharging to the sanitary sewer
☐ Soil contamination or activation
☐ Any underground pipes/ductwork that contains chemical or radioactive material/contamination
☐ Other environmental aspects related to your work (specify):
☐ Process Assessment Form required (determined by ECR or other qualified person)

III. DEVELOP AND IMPLEMENT HAZARD CONTROLS

*For each hazard identified in the previous section, describe how that hazard is controlled. Identify the **Engineering Controls (e.g., interlocks, shielding), Administrative Controls (e.g., procedures, RWPs) or Personal Protective Equipment (e.g., respirators, gloves; see the Personal Protective Equipment Subject Area**) that will be employed to reduce hazards to acceptable levels.*

*The Experiment Review Coordinator, along with the **Principal Investigator** (PI) and Building Manager, as appropriate, will evaluate this experiment for impacts that will require an update to the Facility Use Agreement (FUA), and or Fire/Rescue Run Cards.*

*The **PI** develops and implements hazard controls in consultation with, and using feedback from, the personnel who will be performing the work.*

A. Physical Hazards/Controls

Hazard	Controls (Administrative, Engineered, Protective Equipment)
Material handling equipment	As users, we will not operate any forklifts, or cranes. However, we need a forklift to unload the magnet, and place it to the designated spot. Trained ATF staff will do that job.
Electrical hazard	A high voltage may develop on the magnet leads during a quench if the internal diodes fail, which is highly unlikely. Anyway, currently leads are open/exposed, - we need to cover them on the magnet side, and on the power supply side.
Compressed gases	LACARA researches will perhaps only need training on compressed gases to recharge / add some He at 235 psig into the cryocooler. During the recharging one must follow "Operation manual: The Helium Gas Charging Procedure" document

	developed, and distributed by Janis Research Company, INC. Only a printed version is available. A copy of it will be submitted to the ESR committee on request.
Pressurized vessels or systems	There is a manometer on the compressor to check pressure; it must not exceed 235-242 psig. Follow "Operation manual for Advanced 4 K closed cycle refrigerator systems from Janis and SHI" document developed, and distributed by Janis Research Company, INC. Only a printed version is available. A copy of it will be submitted to the ESR committee on request. Appropriate BNL training is required prior to any work with the cryocooler.

Note: Include maintenance, inspection and testing, and formal calibration, including frequency as appropriate.

B. Chemical Hazards/Controls

Hazard	Controls (Administrative, Engineered, Protective Equipment)
NONE	

Note: Refer to the Working with Chemicals Subject Area for requirements regarding particularly hazardous chemicals such as carcinogens, reproductive toxins, and highly acute toxins, including postings, decontamination plan, and address above.

C. Environmental Hazards/Controls

Hazard	Controls (Administrative, Engineered, Protective Equipment)
NONE	

Note: Identify the requirements from applicable waste management subject area (hazardous, radioactive, mixed, regulated medical). List all applicable environmental permits (Suffolk County Art. XII, Title V Emission Source, etc.) and the relevant controls required by those permits.

D. Radiation Hazards/Controls

Hazard	Controls (Administrative, Engineered, Protective Equipment)
Ionizing Radiation	Ionizing radiation is caused by the electron beam produced, and used at ATF. ATF has already a list of developed procedures, and safety regulations to handle this type of hazard. We will follow all ATF procedures, and safety regulation to control this hazard.
Class II, III a, or III b (visible<15mW) lasers	The appropriate BNL training must be completed prior to any work with this laser. We are planning to use one HeNe laser for alignment. The laser beam will be in an enclosure, and basically observed by CCD cameras during the operation. However, during the equipment installation it will be in the air, so one must follow the ATF/BNL standard procedures while working with such laser.
Class IIIb (nonvisible>15mW) or IV lasers	The appropriate BNL training must be completed prior to any work with this laser. We are planning to deliver the CO_2 laser beam to the magnet, terminating in a laser dump (see BL2-side.bmp). The laser beam will be in an enclosure, and observed by monitors during the operation. However, during the equipment installation it will be in the air, so one must follow the ATF/BNL standard procedures while working with such laser.
Static magnetic field ≥ 600 Gs	The appropriate BNL training must be completed prior to any work with the magnet. We will post the Field Map information near the experiment location; marking 600, 60, and 5 Gs contours by appropriate signs; and issuing the voice notification every time the magnet is being energized. The proper Magnetic Field Hazard (sign #3) must be posted. The power supply is designed to control the magnet during energizing, deenergizing, and normal mode of operation. In case of external power failure, the power supply safely brings the magnet to the zero-current. It also zeroes the replenishing current to the magnet during a quench, and locks itself so that an

	operator cannot restart it, unless unlocked.
Static magnetic field exposure	See attached exposure form.

Note: List sources/materials. Attach or refer to Radiation Work Permits.

E. Biological Hazards/Controls

Hazard	Controls (Administrative, Engineered, Protective Equipment)
NONE	

Note: List additional approvals/permits/reviews required (e.g., BNL Biosafety Committee approval).

F. Offsite Work Hazards/Controls

Hazard	Controls (Administrative, Engineered, Protective Equipment)
NONE	

Note: List the location of all off-site work and identify any off-site organization whose ESH requirements will be followed (e.g., other DOE Labs). Indicate additional controls (not specified above) that are needed.

G. Security Issues/Controls

Issue	Controls (Administrative, Engineered, Protective Equipment)
NONE	

Note: See the Security Checklist, and, if necessary, consult the security office at 4691 or 4496 for more information or guidance.

IV. PERFORM WORK WITHIN CONTROLS

All work shall be performed within the controls identified within this document. It is the PI's responsibility to ensure that this document is kept up to date. The PI should consult with the ERC as appropriate to determine if changes to this document are significant enough to require a new review/document.

If a hazard assessment may be required for this experiment, the PI should contact the ES&H Coordinator and/or the ERC for assistance. The PI should document any hazard assessments performed for this experiment in Section VI.

A. Training

List all project personnel, indicating they are authorized and competent to perform the work described. List the training required for each individual. Identify any certifications or experiment-specific training required. Indicate if any project personnel are minors (under 18 yrs. of age). Contact your Training Coordinator and ES&H Coordinator as appropriate for assistance.

It is the responsibility of the PI to maintain a complete up-to-date list of personnel and their full training requirements, and to ensure that training and qualifications are maintained. A sample ESR signature form is available.

Name	Life/Guest #	Required Training (Course or JTA code)
Sergey Shchelkunov	T9141	PO-04 (ATF Facility User) ATF Linac operator GE-74A (Laser Med Surv) GE-59 (Compressed Gas Worker) ??-Static Magnetic Field Med Surv?
Michael LaPointe	L6922	PO-04 (ATF Facility User) ??-Static Magnetic Field Med Surv?

Note: The BNL Training and Qualifications Web Site contains course offerings and descriptions, required training checklist, as well as employee training records.

B. OSHA/DOE Required Medical Surveillance

Indicate if potential exposure is in excess of trigger levels listed. Exposure evaluation and/or medical surveillance may be required. Additional training may be required for any indicated agent. See the SBMS for additional information and controls on the hazards listed.

Regulated Hazard	**Hazard Specific Training Trigger**	**Medical Surveillance Exposure Trigger**
☐ None		
☐ Inorganic Arsenic	Any day above the OSHA action level (without regard to respirator use)	30 days/year above the action level (without regard to respirator use)
☐ Biohazards (CDC/NIH/WHO listed Agent)	None	See Subject Area for guidance
☐ Cadmium	Any day above the OSHA action level	30 or more days/year at or above the action level
☑ Lasers	Use Class IIIb or Class IV Lasers	Use Class IIIb or Class IV Lasers
☐ Lead	Any day above the OSHA action level	30 or more days/year at or above the action level
☐ Methylene Chloride	Any day above the OSHA action level	- 30 days/year at or above the action level - 10 days/year above the 8-hour TWA PEL or the STEL - Any time above the 8-hour TWA PEL or STEL for any period of time where an employee at risk from cardiac disease or other serious MC-related health condition and employee requests inclusion in the program
☐ Noise	Any day above the ACGIH TLV	Any time equal or greater then 85 dBA TWA 8-hour dose
☐ OSHA Regulated Chemicals *Acrylonitrile* *Benzene* *Benzidine* *1,3 Butadiene* *4-Dimethyl aminoazobenzene* *Ethylene oxide* *Ethyleneimine* *Formaldehyde* *Vinyl Chloride*	Any day above the OSHA PEL	- Routinely above the action level (or in the absence of an action level, the PEL) - Event such as a spill, leak or explosion results in the likelihood of a hazardous exposure
☐ Static Magnetic Fields	Worker who routinely works in magnetic field	- Any time at ≥ 0.5 mT (5 G) for Medical Electronic Device wearer - Any day at ≥ 60 mT (600 G) to whole body [8 hour average] - Any day at ≥ 600 mT (6000 G) to limbs [8 hour average] - Any Time at ≥ 2 T (20,000 G) to whole body [ceiling] - Any time at ≥ 5 T (50,000 G) to limbs [ceiling]

C. Emergency Procedures

Identify any emergency actions, procedures, or equipment that must be in place to insure personnel safety and environmental protection. Include the location of emergency shutoffs, and spill control materials.

Follow ATF Emergency Procedures.

D. Transportation

Identify materials, hazards and controls for any on-site and off-site transportation of hazardous and/or radioactive materials. See relevant SBMS Subject Areas.

None.

E. Notifications

The PI or designee should notify building occupants of any activities that might impact them or their work, and document this here. List external personnel/organizations that require notification related to experimental activities and/or to be notified of changes (e.g., a BNL Committee for review/approval, Occupational Medicine Clinic, Fire/Rescue).

None.

F. Termination/Decontamination

Describe any decommissioning plan, including decontamination of the area at termination of the experiment. Identify any hazards and controls, special precautions or procedures. Include chemical and waste reconciliation. Indicate if a walk-down or an ERE will be scheduled to ensure the area is suitable for future projects. Indicate if Work Permit Form/Procedure will be used.

Activation check is required before removal of beamline hardware from the ATF experimental hall. All materials and equipment will be removed from the ATF and returned to the appropriate institution(s), at their expense, upon completion of the project.

G. Community Involvement Issues

Identify issues that may require community involvement (see the Community Involvement in Laboratory Decision-making Subject Area) and describe the plan that addresses these issues. Attach the Community Involvement Checklist.

None.

V. PROVIDE FEEDBACK ON ADEQUACY OF CONTROLS AND CONTINUE TO IMPROVE SAFETY MANAGEMENT

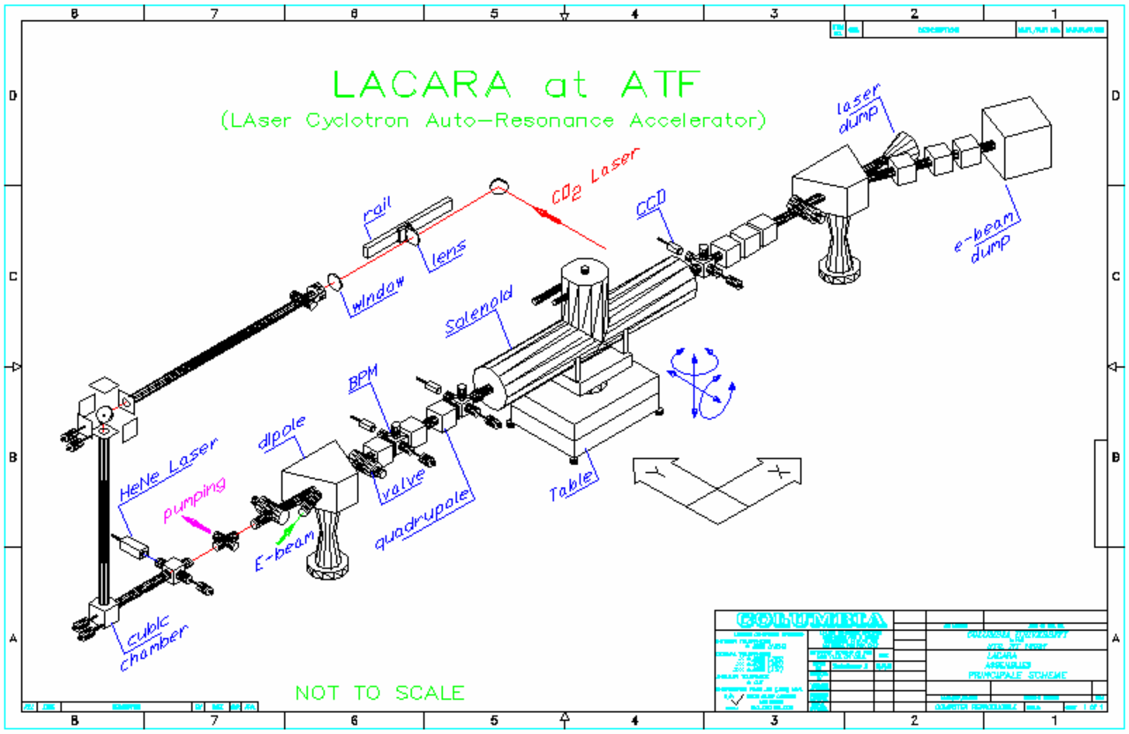
Provide comments on the review process, including this form and communication. Identify any lessons learned or worker feedback contributing to modifications/improvements to the controls or process.

None.

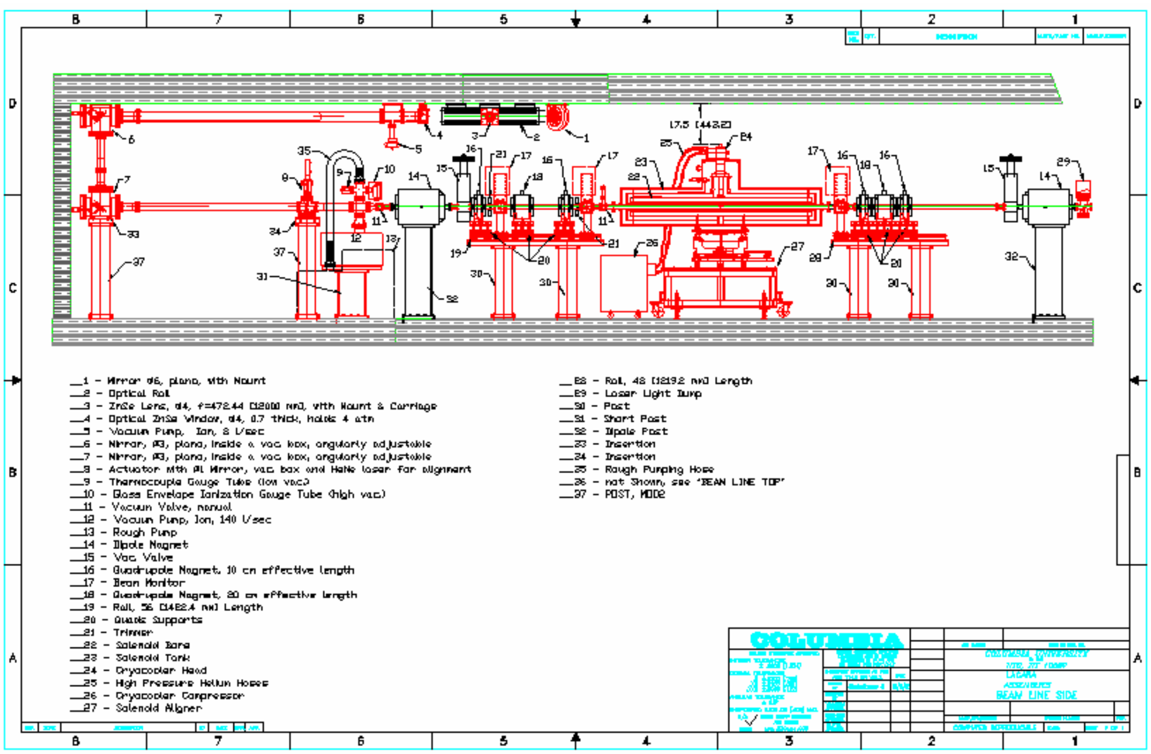
VI. ATTACHMENTS

Use this section to include any supporting documents, hazard assessments, figures, tables, etc. that were not entered into the previous sections of the form.

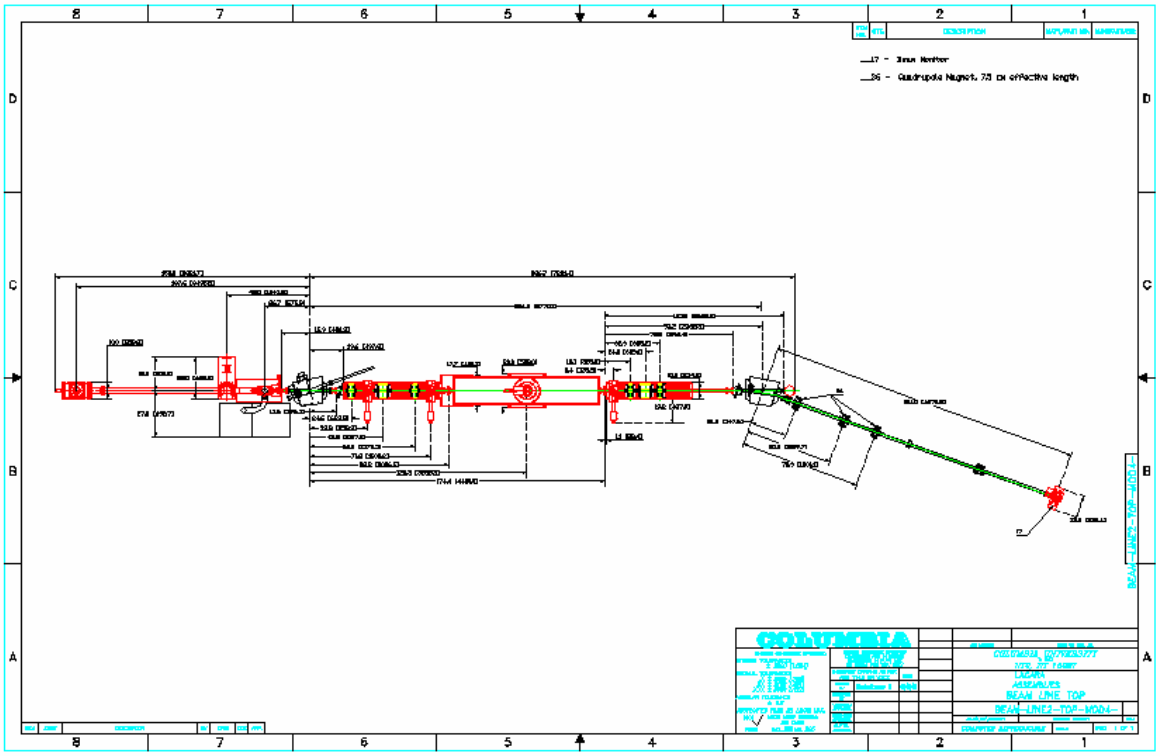
1. LACARA.bmp – the layout of LACARA



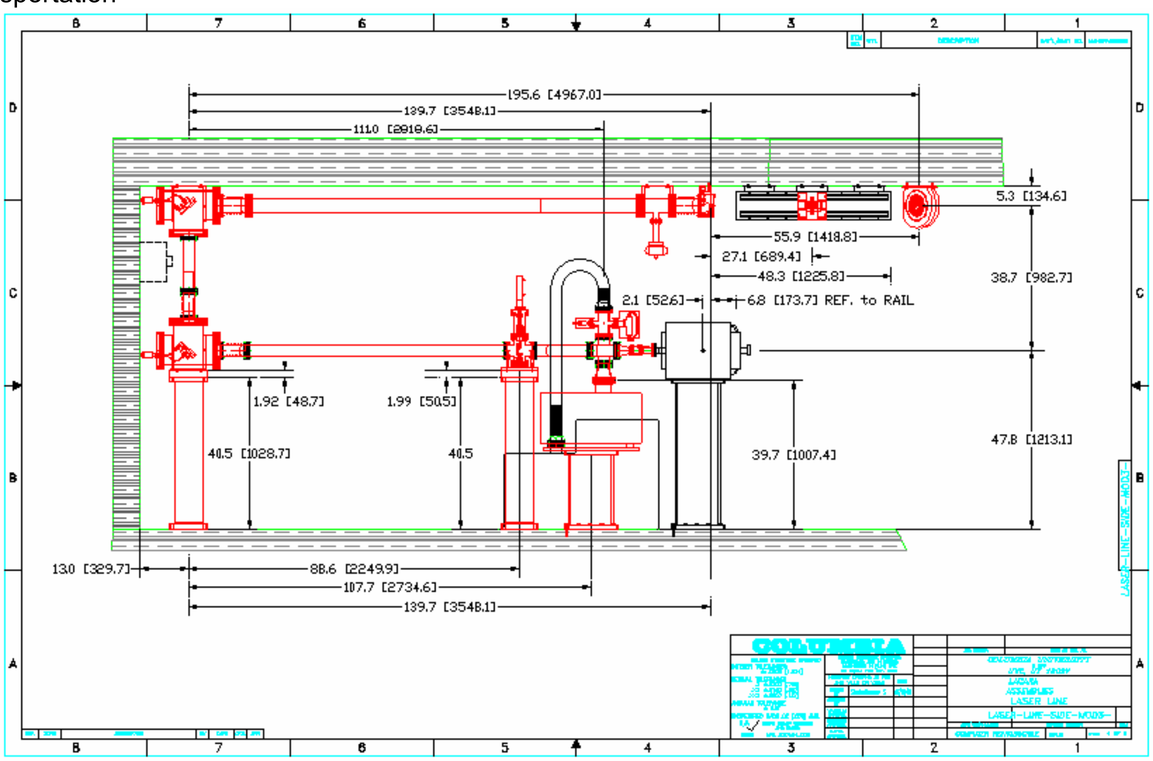
2. BL2-side.bmp – the 2nd beam line drawing, side view



3. BL2-top.bmp – the 2nd beam line drawing, top view



4. LaserTransport.bmp – a drawing of some details regarding the laser transportation



5. Magnet.doc – a description of the magnet (1 page), its drawing (2 page), and field map (3 page)

This is a magnet/supplemental parts description.

1) **The magnet** is a solenoid with dimensions (**see Figure 1** on the page #2):
   Inches: ∅ 15’’ by 54’’ LEN,
   Metric: ∅ 400 mm x 1370 mm LEN.),
   Weight 1000 lbs = 450 kilos.
   Magnetic field up to 60,000 Gs (6 T) on the axis inside, *and at the full operating current* **the filed map** (top view, at the full current) **is given in Figure 2** on the page #3.
   Operating temperature of the coil is around 4^0 K (cryocooled magnet).
   The magnet has a power supply that requires:
   AC 110 V, 15 Amps, 60 GHz, standard power load (for instance, the magnet consumes only 70 Watts during the charging).

2) We also need to bring a cooler compressor, which has dimensions:
   450 mm x 500 mm x 684 mm HGT,
   Weight: 255 lbs = 115 kilos.
   This compressor is detached from the magnet.
   The compressor will have in total 406.4 liters of 1 atm He (25.4 liters when compressed to about 235 psig).
   The cooler compressor requires:
   AC 208 V, 3 Phase, 60 GHz, steady power 7.5 kWatts, overloads up to 8.3 kWatts
   Water pump: 7 liters/min, 3/8 NPT Male, temperature 4-28 ^{0}C.
   The floor should be flat; the slope must be less than 5^0.
   When moved the compressor must not be tipped by more than 30^0 (it has small wheels).

3) We have to have (available from ATF):
   A turbo pump, a leak checker, a vacuum gage, and a He cylinder with at least 235 psig to fill the compressor

4) Any fork truck operations (if any) to lift the magnet must be done on a flat, smooth concrete floor. The magnet can be relocated from one place to another only in the warm state (it is a fragile thing due to some specific coil suspension inside the tank).

5) Time frame to energize, and deenergize the magnet:

Pump down:	2 days (48 hours)
Cool down:	4 days (96 hours)
Energize to full current:	1/2 days (11 hours)
Deenergize:	1/2 days (11 hours)
Warm up:	4 days (96 hours)
Bring to atm pressure:	3 hours (needs bleeding up with Nitrogen 99.999%)
Total:	11 - 12 days (264 – 288 hours)

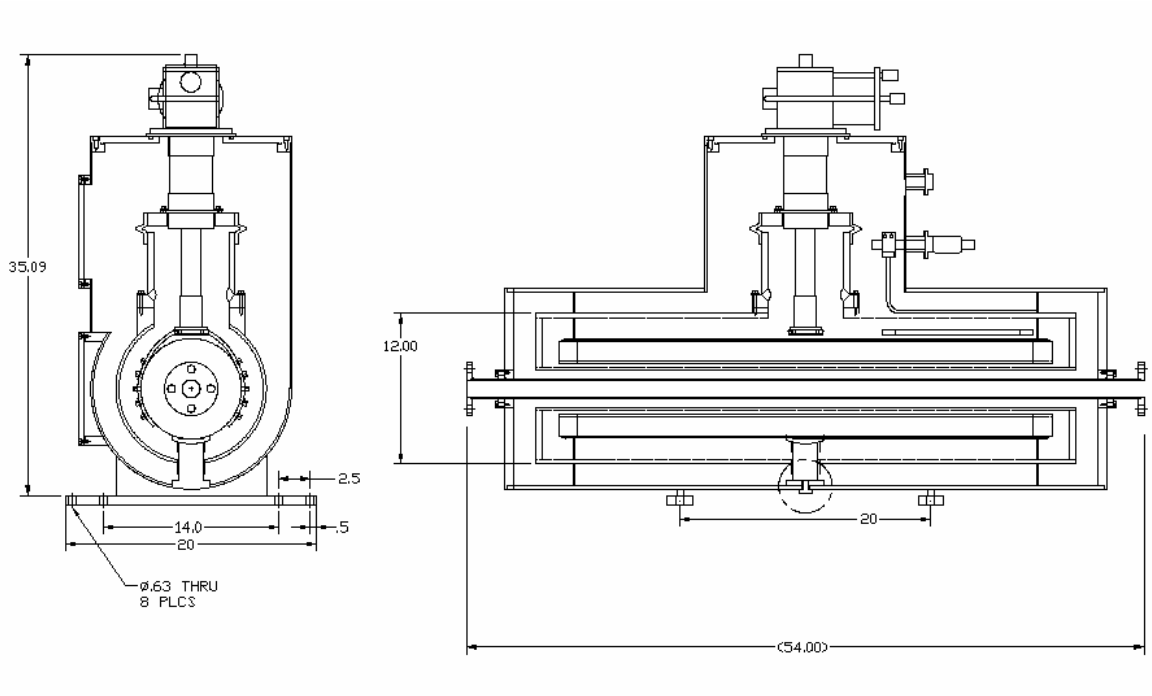
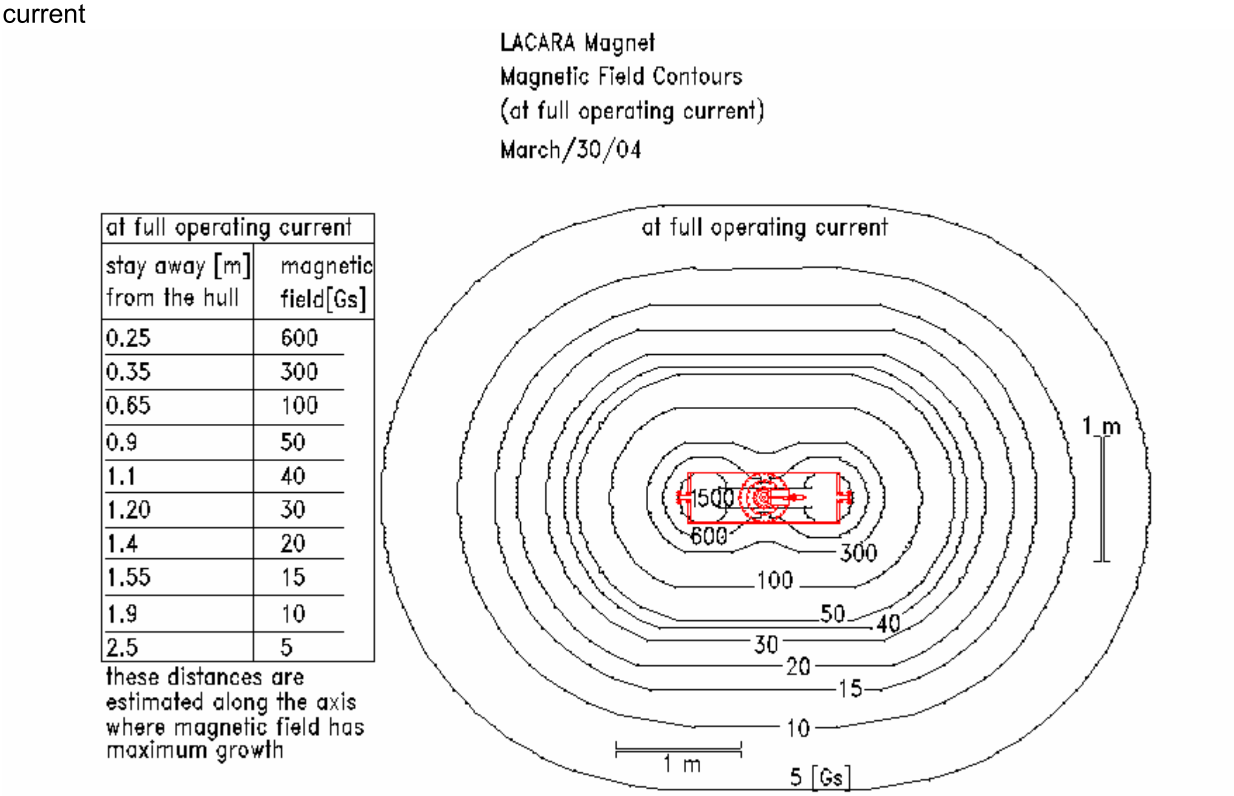


FIG.1: Magnet

FIG.2. Field map at the full current:

6. FieldMap.bmp - Magnetic field map at the full operation current



at full operating current	
stay away [m] from the hull	magnetic field[Gs]
0.25	600
0.35	300
0.65	100
0.9	50
1.1	40
1.20	30
1.4	20
1.55	15
1.9	10
2.5	5

these distances are estimated along the axis where magnetic field has maximum growth

7. ODH of LACARA – evaluation of the oxygen depletion in the ATF experimental hall.

   There is no liquid He in the cooling system, only He gas at 16 atm.

   The entire system holds 25.4 liters of gas at 16 atm. If all this escaped, it would produce 25.4 liters X 16 atm = 406 liters of gaseous He X .035 cu.Ft./liter = 14 cu. ft. The volume of the experimental hall is approximately 7000 cubic feet. A conservative calculation indicates that the addition of 14 cubic feet of He would reduce the oxygen concentration from 21% to 20.95%.

   Initially there is 0.21 X 7000 = 1470 cu. ft of oxygen. After the spill and warming of the He, 14 cu. ft. of air is displaced with helium. This means 0.21 X 14 = 3 Cu. Ft of oxygen is lost from the room. The final amount of oxygen left is 1470 - 3 = 1467 cu ft. This results in an oxygen content of 1467 / 7000 =20.95 %.

   Thus, the LACARA experimental magnet does not constitute an ODH hazard.

8. Magnet-test.doc – the document describing the magnet test.
9. BNL MagneticField Exposure Form.

Magnet test (the total time is estimated to be around 10 days):

a.1) Connecting a turbo-pump, and a vacuum gauge to the magnet tank. Bringing the vacuum below 1e-6 Torr. Leak-checking. (The estimated time to achieve 1e-6 Torr is about 2 days (48 hours).

a.2) Placing the compressor about >2.5 m away from the magnet. Connecting compressor to the magnet cryocooler head with two high-pressure hoses. Checking the pressure to be 235 psig. If required, replenishing the He gas (purity 99.999%) inside the compressor, cryocooler head, and hoses. (There is some He gas inside the compressor, cryocooler head, and hoses already. High pressure ports on the compressor, and cryocooler head to which the hoses are connected are equipped by valves. Either hose end is also equipped by a valve of the same type. When a hose is disconnected valves are closed; when a hose is connected to the compressor valves open.) To replenish the He gas (purity 99.999%) connect a helium cylinder, set a pressure regulator to 235-24 psig (16.5 -17 kgf/cm/cm/G) and open the valve of gas charging slowly; check pressure to be 235 psig; disconnect the helium charging line. Connecting the compressor to AC 208 V, 3 phase, 60 Hz, overloads up to 8.3 kW.

a.3) Connecting a water pump (7 liters/min) to the compressor.

a.4) Placing the temperature meter about >2.5 m away from the magnet. Connecting wires to the temperature sensors. Turning on the temperature meter (requires usual AC 110 V)

a.5) Starting the compressor. Once the compressor is started, disconnect the turbo-pump, and shut the vacuum valve. From this point the temperature must be controlled, and periodically recorded. (The estimated time to cool down the magnet coils to the operational temperature of -4 K is about 4 days (96 hours).

a.6) Placing the power supply about >2.5 m away from the magnet. Connecting wires, and cables. Connecting the power supply to AC 110 V (requires only 70-100 W)

a.7) Waiting for the temperature to get to the operational point (4 days).

a.8) Energizing the magnet. Bringing it to the full current of about 76 Amps (6 T inside). Periodically taking the measurement of magnetic field with Hall probes. (One training quench should be expected). (The estimated time without a quench is around 1/2 day (11 hours); with a quench the estimated time will be around 1 & 1/2 day (36 hours)

a.9) Once at the full current, measuring the field profile inside, and checking for 600, 60, and 5 Gs contours outside the magnet. (The estimated time 1/4 day (6 hours)

a.10) Deenergizing the magnet. (The estimated time is 1/2 day (11 hours)

a.11) Warming up the magnet, and bringing its tank to the atmospheric pressure. It requires bleeding up with the Ne gas (purity 99.999%). (The estimated time 1/8 day (3 hours).

a.12) Disconnecting all wires, cables, hoses. Packing or wrapping the equipment for a safe storage.

BNL Static Magnetic Fields Exposure Form
Part A: Source Hazard Assessment Record

USE THIS FORM TO DOCUMENT MAGNETIC FIELD SOURCES THAT ARE AT OR EXCEED 0.5mT (5 GAUSS)
Line Managers or Principal Investigators, and ES&H Coordinators complete a separate form for each Static Magnetic Field source. This assessment applies to occupational exposures only. This assessment does not apply to unmodified consumer products (phones, computer terminals, magnetic stirring devices, refrigerator magnets, etc.) that are used as intended.

I. Source Identification

Department: Physics Department, ATF	Building: 820	Room or Area (location of source): High bay area, ATF experimental hall (this exposure form is only for the magnet test in the ATF high bay area, or the place assigned by the committee) (for the ATF experimental hall we need to prepare another form)

Identifier/ Name of Source:

Superconductive Magnet for the LACARA experiment

Status of Source Usage (check all that apply):
[ ] In use on frequent basis [**X**] Planned use in the near future [ ] Possible future use [ ] No planned use
[**X**] Intermittent use [ ] One-time use [ ] Other:

Check or Describe Use or Process: [ ] permanent magnet [ ] medical device [ ] Magnetic Resonance Imaging equipment
[ ] Nuclear Magnetic Resonance equipment [**X**] super-conducting coils [ ] magnetometers [ ] accelerator magnets
[ ] detector magnets [ ] ion pumps [ ] electron microscope [ ] beam transport magnet [ ] electromagnet lifting device
[ ] other (specify):

II. Exposure Summary [Complete Part B: Field Strength Measurement Record *or* attach documentation from manufacturer]

Target Body Area	BNL Exposure Limits (mT)	(G)
Cardiac Pacemaker (Ceiling)	0.5	5
Ferromagnetic Objects (Ceiling)*	60	600
Torso or Head (Whole Body) (8-hour TWA)	60	600
Extremities (Limbs) (8-hour TWA)	600	6,000
Whole Body (Ceiling)	2,000 (2 T)	20,000
Extremities (Limbs) (Ceiling)	5,000 (5 T)	50,000

*Ferromagnetic Objects (Ceiling), including medical implants and prostheses, may be affected by fields. Additional evaluation is required.

Maximum Exposure Potential surveyed applicable to worker exposure:

III. Exposure Hazard Evaluation [Check all that apply]

1. [ ] **Field Strength does not exceed 0.5mT (5 Gauss). Go to section V.**

2a. [X] **Field strength is at or exceeds 0.5 mT (5 Gauss). No potential for individuals with medical electronic devices to be exposed above exposure limits. Explain in line 4.**
2b. [ ] **Field strength is at or exceeds 0.5 mT (5 Gauss). Individuals with medical electronic devices* may be affected. List users of cardiac pacemakers and other medical electronic devices in Part C: Employee Exposure Record.**

3a. [X] **Field strength is at or exceeds 60 mT (600 Gauss) but for less than 8 hours TWA. No individuals with medical electronic devices* or ferromagnetic implants/prostheses** present.**
3b. [ ] **Field strength is at or exceeds 60 mT (600 Gauss) but for less than 8 hours TWA. Individuals with medical electronic devices* or ferromagnetic implants/prostheses** may be affected. List users of medical electronic devices or ferromagnetic implants/prostheses in Part C: Employee Exposure Record.**
3c. [ ] **Field strength is at or exceeds BNL Exposure Limit (8-hr. TWA or ceiling limit). No potential for individuals to be exposed above BNL Exposure Limit. Explain in line 4.**
3d. [ ] **Field strength is at or exceeds BNL Exposure Limit (8-hr. TWA or ceiling limit). Potential for individuals to be exposed above BNL Exposure Limit. List the names of individuals in Part C: Employee Exposure Record.**

* Medical electronic devices includes cardiac pacemakers, electronic inner ear prostheses, insulin pumps.
** Ferromagnetic implants/ prostheses includes aneurysm clips, replacement hips.

4. Describe job/task and potential for employee exposures (e.g., type of work performed around source, method of control, time spent in fields [hours/day] and method of determining exposure):

Type of work: this is only for the magnet test in the ATF high bay area, or the place assigned by the committee)

#1) Energizing the magnet. Bringing it to the full current of about 76 Amps. See the attached field map for the magnetic field outside the magnet. Inside the magnet the field at 76 Amps will be 6T, - this region is accessible only by probes. Periodically taking the measurement of magnetic field with Hall probes inside, and outside the magnet. (One training quench should be expected). (The estimated time without a quench is around 1/2 day (11 hours); with a quench the estimated time will be around 1 & 1/2 day (36 hours)
#2) Once at the full current, measuring the field profile inside, and checking for 600, 60, and 5 Gs contours outside the magnet. (The estimated time 1/4 day (6 hours)
#3) Deenergizing the magnet. (The estimated time is 1/2 day (11 hours)

Method of control:

#1) Using Hall probes
#2) See section IV of this document for other types of control

Time spent in fields:

#1) We are going to work mostly at the distance >2.5 m away from the magnet, where the magnetic field does not exceed 5 Gs. The exposure time to this field is for about 1- 2 days.
#2) The Hall probes we are going to use to measure the magnetic field are attached to the nonmagnetic (aluminum) rods to be inserted inside the magnet from a safe distance. The closest distance at which a body is posed will not be less than 0.5 m, where the field does not exceed 250 Gs. The total time of body exposure to the field of up to 250 Gs is about 1/2 hour (or less). The closest distance at which an arm is posed will be not less than 0.15 m, where the field does not exceed 1500 Gs. The time of arm exposure to the field of up to 1500 Gs is about 10 min. in total.
#3) The occasional exposure to fields higher than 5 Gs is possible if one comes close to the magnet. The field is up to 1500 Gs in maximum. We are going to clearly mark the area contour at about 1 m away from the magnet, where the field does not exceed 50 Gs, so that one will be alerted not to enter beyond this contour line.

Method of determining exposure:

The previous subsection used the exposure amount determined by SAM code (distributed, and maintained by BINP, Novosibirsk, Russia). We did a measurement of the magnetic field along the magnet axis that confirmed that the computed numbers, and measured numbers are in a perfect agreement. We also found that the points corresponding to the 5 Gs field are well agreed with the computations. Thus, the provided field map simulated by SAM can be used to determine the field strength around the magnet.

Anyway, during the current raising we will take periodically (at 20, 50, 76 Amps) the measurement of the field strength to determine the 5 Gs safe contour (we always reassess the expected filed as “full expected field” = “measured field” X “76 Amps”/ “measured current” because the operational full current will be around 76 Amps) since it may be affected by the presence of metal armature/fixture in a concrete floor.

5. Frequency of exposure (e.g., # days per year or month, # tests per year, in continuous use, etc.):

For this work it will be 2 days or less.

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form
Part A: Source Hazard Assessment Record

IV. Precautions / Engineering & Administrative Controls

Precautions During Use (check all that apply):

_**X**__ Signs
___ Lights
_ __ Barriers
___ Restricted access
__ _ Rotation of workers
_**X**__ Working when de-energized
_**X**__ Use of nonferromagnetic tools
_**X**__ Physical indicator of fringe fields (e.g., use of string with paper clips or equivalent)

Other:

Written Documentation:

_**X**__ Experimental Review (Work Planning and Control for Experiments and Operations Subject Area)
___ Work Planning and Control (Work Planning and Control for Experiments and Operations Subject Area)
___ Written SOP (describe):

Other workers who may require information/written documentation/training to enter this area:

Karl: If we do a test in the high bay area, what about the RHIC vacuum group people?

Checklist:

Employee training required: _**X**_ Static Magnetic Fields Web Course ____ Dept/Division-Specific Training
Supervisors training required: ____ Static Magnetic Fields Web Course ____ Dept/Division-Specific Training
Training required to be linked in Job Training Analysis for affected work groups / job classifications: ____yes ____no

Medical approval required for individuals with medical electronic devices _X_ yes ____ no
Medical review required for individuals above 8-hour TWA or ceiling ____ yes _X_ no

V. Initial Assessment

Completed by: **Sergey V Shchelkunov (T9141)**	**Date:** **04/14/04**
Reviewed by ES&H Coordinator:	**Date:**

Forward the original form to the Static Magnetic Fields Subject Matter Expert, copies to your ES&H Coordinator and Facility Support Representative. Retain a copy in your files. Update and resubmit the assessment when changes occur.

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form
Part B: Field Strength Measurement Record

Field Strength Measurement Record	
DATE:	**SURVEYOR:**

I. AREA INFORMATION		
DEPT.:	BLDG.:	ROOM:
SOURCE:		
CONTROLS: ___ BARRIERS ___ SIGNS ___ USE NON-FERROMAGNETIC TOOLS ___ OTHER:		
II. SURVEY INSTRUMENT INFORMATION		
INSTRUMENT:	MODEL:	SERIAL#:
FACTORY CALIBRATION DATE:	FUNCTIONAL CHECK (Test of meter response to known magnetic source) DATE:	

III. SAMPLING INFORMATION & RESULTS	
HAZARD: STATIC MAGNETIC FIELDS	UNITS: ___ mGauss _**X**__ Gauss ___ mTesla ___ Tesla ___Amp/meter

INDICATE WHERE READINGS WERE TAKEN IN THE TABLE BELOW AND ON THE SKETCH (GRID) ON NEXT PAGE. EQUIVALENT METHODS OF DOCUMENTATION MAY BE ATTACHED (E.G., PICTURE, PLAN VIEW WITH EXPOSURE LEVELS INDICATED)

DISTANCE FROM SOURCE	LOCATION	READING	COMMENTS

BNL Static Magnetic Fields Exposure Form

Part B: Field Strength Measurement Record

Continuation of Section III.

INDICATE WHERE READINGS WERE TAKEN IN THE TABLE BELOW AND ON THE SKETCH (GRID) BELOW. EQUIVALENT METHODS OF DOCUMENTATION CAN BE ATTACHED (E.G., PICTURE,PLAN VIEW WITH EXPOSURE LEVEL INDICATED)			
DISTANCE FROM SOURCE	LOCATION	READING	COMMENTS

Sketch of Survey Area. (Indicate positions on map where measurements were made.)

Forward the original form to the Static Magnetic Fields Subject Matter Expert, copies to your ES&H Coordinator and Facility Support Representative. Retain a copy in your files. Update and resubmit the assessment when changes occur.

FILE CODE: IH95SR. FORM IH-SMF (v1.0)

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form
Part C: Employee Exposure Record

Employee Exposure Record

DATE:	COMPLETED BY:

I. AREA INFORMATION

DEPT.:	BLDG.:	ROOM:
SOURCE:		

NOTE: MEASUREMENTS OR CALCULATIONS IDENTIFY THE INDIVIDIUALS BELOW TO HAVE THE POTENTIAL FOR EXCEEDING REGULATORY EXPOSURES LEVELS.

II. EMPLOYEE INFORMATION

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (Hrs):	EXPOSURE (Times per Day):	EXPOSURE (Days per Yr):
JOB/TASKS PERFORMED:		
Check all that apply: __ MEDICAL ELECTRONIC DEVICE USER or	____ FERROMAGNETIC PROSTHESIS &	____ Exposure above BNL Exposure Limit ____ Exposure above 5 Gauss

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (Hrs):	EXPOSURE (Times per Day):	EXPOSURE (Days per Yr):
JOB/TASKS PERFORMED:		
Check all that apply: __ MEDICAL ELECTRONIC DEVICE USER or	____ FERROMAGNETIC PROSTHESIS &	____ Exposure above BNL Exposure Limit ____ Exposure above 5 Gauss

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (Hrs):	EXPOSURE (Times per Day):	EXPOSURE (Days per Yr):
JOB/TASKS PERFORMED:		
Check all that apply: __ MEDICAL ELECTRONIC DEVICE USER or	____ FERROMAGNETIC PROSTHESIS &	____ Exposure above BNL Exposure Limit ____ Exposure above 5 Gauss

Forward the original form to the Static Magnetic Fields Subject Matter Expert, copies to the Occupational Medicine Clinic, your ES&H Coordinator, and Facility Support Representative. Retain a copy in your files. Update and resubmit the assessment when changes occur.

Lessard, Edward T

From: Travis, Richard J
Sent: Wednesday, August 11, 2004 4:06 PM
To: Shchelkunov, Sergey
Cc: Kusche, Karl; Gill, Ronald L; Lessard, Edward T; Bernholc, Nicole M; Ellerkamp, John J; Travis, Richard J
Subject: RE: LESHC 04-04 LACARA - Status of LESHC Testing Prerequisites

Sergey,
I will review the LESHC actions and take a walk over tomorrow morning. If you would like, I can meet you there at your convenience.

Nicole had noticed the LACARA power cord that is now routed through the door to the laser room. That prompts a couple of concerns:

1. Please confirm that the slightly open door to this laser room does not pose a hazard to the laser room occupants, or other personnel in the vicinity of your experiment. 2. If that's the case please post the door on both sides to prevent it's use. (One concern is someone from the LACARA entering the Laser room and being injured. I would assume you would not want egress from the laser room through your experiment, either.) 3. Please protect the power cord where it contacts the edge of the door.

Rich

-----Original Message-----
From: Shchelkunov, Sergey
Sent: Wednesday, August 11, 2004 3:09 PM
To: Travis, Richard J
Cc: Kusche, Karl
Subject: RE: LESHC 04-04 LACARA - Status of LESHC Testing Prerequisites

Dear Richard,
Good Afternoon,
1.) Please, find the revised "Magnetic Field Exposure Form".
I sent a copy to Nicole yesterday, and today (Aug-11-04) I have called here and been told that she approves this version.
2.) I installed all signs (as you and she requested/recommended) and fixed all other items as noted in your e-mail (see a copy below). We will fully stretch the fence along the 5 Gs perimeter prior to magnet energizing.
3.) Currently, we would like to receive your "go ahead" to start cooling down. Thank you, Sergey (ext= 2505) -----Original Message-----
From: Travis, Richard J [mailto:travis@bnl.gov]
Sent: Friday, August 06, 2004 1:55 PM
To: Lessard, Edward T
Cc: Shchelkunov, Sergey; Gill, Ronald L; Kusche, Karl; Bernholc, Nicole M; Curtiss, Joseph A; Ellerkamp, John J; Travis, Richard J
Subject: LESHC 04-04 LACARA - Status of LESHC Testing Prerequisites Ed, Sergey, Ron, Karl and I met in the high bay of Bldg 820 on Wednesday 8/4/04 to review the status of the LESHC prerequisites for the start of LACARA testing. The conditions from Motion 1 of the LESHC 04-04 meeting minutes were reviewed and are listed below. A status (and any additional required actions) is provided for each of the nine conditions for LACARA testing. As info, I start Jury Duty call in this afternoon, so I may be out of the office for a portion of next week. Ron, I got the signed off cover sheet for the ESR. Thanks! I trust you enjoyed your trip to Acadia. Rich

1.2.1. Motion No. 1 -The proposal to test the LACARA magnet in the Bldg. 820 High Bay is approved, subject to the following conditions:

1.2.1.1. Install a fence for access control during the test period. (Orange plastic snow fence is acceptable.) The fence must be located outside the 5 gauss line and enclose all of the experimental apparatus.

Status: The fence stanchions have been taped to the floor and the majority of the fencing has been installed. There is a pipe rack nearby that is within the 5 gauss line. It will have to be moved to allow the completion of the fencing.

Physics will move the pipe rack and install the remainder of the fencing, per the LESHC requirements, prior to energizing the magnet. (It was noted that in order to expedite the testing, Physics may start the cooldown process, but not the magnet energization, prior to the completion of the fencing.)

1.2.1.2. Mark the 5, 60 and 600 gauss lines on the high bay floor and post the required signage in accordance with the SBMS Subject Area. Please contact the Static Magnetic Fields SME (Nicole Bernholc) for additional guidance.

Status: The 60 and 600 gauss lines are marked on the floor. Physics was requested to mark the tape or apply signage to readily indicate what these boundaries are. The 5 gauss line will be marked on the floor prior to magnet energization. (See above.)

1.2.1.3. Revise the "Static Magnetic Fields Exposure Form" per the Subject Area and the input provided at the meeting. Provide a copy of the revised form to the Committee for review.

Status: Physics to provide the revised Form to Nicole Bernholc (the Static Magnetic Fields Subject Matter Expert), Ron Gill, Ed Lessard and Rich Travis. I suggested that Sergey consult with Nicole prior to submitting the form for our review.

1.2.1.4. Post signage to control the introduction of ferrous objects (e.g. tools) into the area.

Status: Physics to post the required signage.

1.2.1.5. Revise the test and operating instructions to require a sweep (to be performed prior to magnet energization) for ferrous objects.

Status: Procedure currently requires a 3 meter exclusion area for ferrous materials. The present configuration does not satisfy this requirement. Physics to consult with Nicole Bernholc to designate a more workable exclusion area and revise the procedure accordingly.

1.2.1.6. For access control purposes, post signage with points of contact (i.e., names and phone numbers) at the access gate(s).

Status: The signage is posted, but must be revised to include Sergey Shchelkunov.

1.2.1.7. Label the cooling lines for the cryohead in accord with ESH 1.14.0, "Identification of Piping Systems".

Status: Physics to label the cooling lines.

1.2.1.8. Tape the cooling lines to the floor to address the potential tripping hazard.

Status: Physics to provide more slack in the cooling lines so that they stay flat on the floor. They will tape the lines or provide a ramp to address the tripping hazard.

1.2.1.9. Electrically bond and ground all equipment. Cover any exposed conductors (e.g., the current leads on the magnet hull) for personnel protection.

Status: Exposed conductors have been covered. Physics to bond/ground the magnet hull assembly.

Lessard, Edward T

From: Bernholc, Nicole M
Sent: Tuesday, August 10, 2004 4:25 PM
To: Shchelkunov, Sergey; Kusche, Karl
Cc: Gill, Ronald L; Travis, Richard J; Edward Lessard; Weilandics, Christopher
Subject: RE: LACARA: Revised Magnet Field Exposure Form
Follow Up Flag: Follow up
Flag Status: Flagged

Hi Sergey; Karl,

I read through the items you forwarded, and the magnetic field exposure form.

I have some questions and comments.

First to answer your questions below:
1. I gather you filled out the form based on theoretic calculations. When the experiment comes up please verify the gauss lines.

2. The lines you drew are in squares. Typically fields do not follow this pattern. If the gauss lines are within the square it is ok, just unusual. Is this a shielded magnet? You may have answered this question in the review, but please refresh me. If it shielded, then the pattern will have a greater magnetic field at the ends where the magnetic is not shielded. As you know, the gradient of the field will depend on the magnet gap. Shielding can also affect this.

If you have theoretical drawings, please attach them. Part B of the Field strength measurement record of the form requests this. You can submit your theoretical survey distances as a preliminary and verify and revise when the magnet comes onlne. I see that such a drawing is in the experiment review. If this is what you are using - indicate where the measurements were taken and attach to the magnetic fields report. Verify when it goes online.

3. If no people have pacemakers, please indicate so on form.

4. On the netting marking the 5 gauss line I suggest putting sign # 1. I know you also put signs up on the machine and that is fine to correspond with the field. If you choose to put some of the other signs on the outside that is also suitable with signs indicating the gauss lines on the floor.

5. For the testing, start at 30 gauss and work your way in towards the magnet. Anywhere you may be putting magnetic items that have the potential for attraction - to insure that they can't be brought in. Mark on the form, and indicate if you find a gradient. Also position items - by stanchions (cones) or other way, to keep items out if your measurements find a gradient. Your personnel will go everywhere I assume= - so anywhere they go that a metallic item can be taken would be good to check out.

6. In the Magnet test you are indicating that many items will be >2.5 meters away from the magnet. Verify that this is so. Why did you pick this number? I assume because this is the approximate 5 gauss line.

7. R. Travis mentioned that in your procedures you required magnetic objects outside a 3 meter area. Rich is right - it does not seem that you are meeting this criteria. As we discussed, you believe that these things can be positioned between the 5 and 25 gauss line. Please revise your statement to indicate this and verify when you turn on the magnet

6. I have a question about the laser operation. You are currently taking power from the room, thereby not leaving that area secured if it is in operation. This is a poor safety practice. Also better signage needs to be on the door the area. Please check with the laser officer regarding interlocks and other signage. What are ATF standard operating procedures for working with lasers?

Also, the main access to the laser experiment appears to be through your experiment. Please check and change the signage so that this doesn't occur.

I hope this is helpful. You have done many things and are aiming at satisfying all checklist items.

Nicole M.Bernholc
Brookhaven National Laboratory
Safety and Health Services Division
Building 120
Upton, NY 11973
Phone 631 344-2027
Fax 631 344-7497
Beeper631 453-5864

-----Original Message-----
From: Shchelkunov, Sergey
Sent: Thursday, August 05, 2004 7:36 PM
To: Bernholc, Nicole M
Subject: LACARA: Revised Magnet Field Exposure From

Dear Nicole,
Good Evening,
I am writing regarding the LACARA experiment(ATF, the highbay of building 820)
1) According to the motions generated at the meeting held on May 12/2004 (see the attachment, please) we need to have a revised "Magnetic Field Form". I am not sure that the last revision I have (see the attachment, please) is what we need.
Could you, please check? - and if this "Magnetic Form" must be revised, explain me what needs to be done.
2) I have several more questions regarding to the motions.
==Motion 1.2.1.4. Post signage to control the introduction of ferrous objects (e.g. tools) into the area.==
I posted the sign #3 (it indicates that we use fields >600 Gs). The 2nd item there says: "Lost of ferrous objects may occur" - is it sufficient? Or, I need to post a special sign? What should it be, then?
3) I need also to know within what distance from the magnet one should perform the sweep of ferrous objects:
I put into the description of our procedures for testing (see Magnet-test2) the sentence saying:
==NOTE: Prior any energizing the sweep for any ferrous objects is required within 600 Gs contour ==

Is this correct?
What sign should I put to indicate that "The sweep for ferrous object is required"?
Thank you,
Sergey (ext= 2505)
(4 attachments, all are .doc-files)
PO2004-099
LESHC 04-40 Draft Minutes-Rev1 (Signed Version)
MagneticFieldExposureFrom
Magnet-Test2

Nicole M.Bernholc
Brookhaven National Laboratory
Safety and Health Services Division
Building 120
Upton, NY 11973
Phone 631 344-2027
Fax 631 344-7497
Beeper631 453-5864

Lacara experiment view 1.

Lacara experiment view 2. Note fencing needs to be erected. Door (not visible) leads into laser area. Power taken from that area.

Magnet Test Procedure and Time Frame
(the total time is 10 days)

this procedure and schedule is
revised by Sergey Shchelkunov
(tel: 631-344-2505)
(e-mail: shchelkunov@bnl.gov)
on August 12/2004

Step #	Time	Description	Comments
Day 1st and 2nd			
1	1 hour	Move the magnet on the test spot	Need help from Don, or Todd to operate a forklift
2	1 hour	Placing the compressor about > 2-2.5 m away from the magnet. Connecting compressor to the magnet cryocooler head with two high-pressure hoses. Checking the pressure to be 235 psig. If required, replenishing the He gas (purity 99.999%) inside the compressor, cryocooler head, and hoses. Connecting the compressor to AC 208 V, 3 phase, 60 Hz, overloads up to 8.3 kW.	
3	10 min	Placing the temperature meter about > 2-2.5 m away from the magnet. Connecting wires to the temperature sensors. Turning on the temperature meter (requires usual AC 110 V)	
4	10 min	Placing the power supply about > 2 - 2.5 m away from the magnet. Connecting wires, and cables. Connecting the power supply to AC 110 V (requires only 70-100 W)	
5	25 min	Installing the orange plastic fence, putting the floor marks, and signs	

6	2 days (48 hours).	Connecting a turbo-pump, and a vacuum gauge to the magnet tank. Bringing the vacuum below 1e-6 Torr. Leak-checking. Bringing a water chiller from NSLS	a. The estimated time is given to achieve 1e-6 Torr b. We need help from Don to operate a turbo-pump. c. We should check with Marty the details of the chiller delivery from NSLS.
4	1 hour	Connecting the water chiller (7 liters/min) to the compressor.	We need help from Don, and Todd to move things around.
Day 3rd ÷ 6th			Before we begin the next stage we should invite the LESH representative to check that we have fulfilled the committee requirements
7	4 days (96 hours).	Starting the compressor. Once the compressor is started, shut the vacuum valve, and disconnect and remove the turbo-pump from the magnet to a distance > 2 m. From this point the temperature must be controlled, and periodically recorded.	The estimated time is given to cool down the magnet coils to the operational temperature of +4 K
Day 7th ÷ 9th **NOTE**: Prior any Energizing the Sweep for any Ferrous Objects (e.g. tools, hardware) is required within 5 Gs contour.			
8	1 & 1/2 day (36 hours) with quench	Energizing the magnet. Bringing it to the full current of about 76 Amps (6 T inside). Periodically taking the measurement of magnetic field with Hall probes. (One training quench should be expected). Periodically checking that the field does not exceed 5 Gs, 60 Gs, or 600 Gs at the lines marked as 5 Gs, 60 Gs, and 600 Gs correspondingly.	Time can be only 1/2 day (11 hours) without quench

9	1/4 day (6 hours)	Once at the full current, measuring the field profile inside, and checking for 600, 60, and 5 Gs contours outside the magnet.	
10	1/2 day (11 hours)	Deenergizing the magnet.	
Day 10th			
11	3/4 day (18 hours).	Warming up the magnet, and bringing its tank to the atmospheric pressure. It requires bleeding up with the Ne gas (purity 99.999%).	We need help from Don to bleed up the magnet tank.
12	1/8 day (3 hours)	Disconnecting all wires, cables, and hoses. Packing or wrapping the equipment for a safe storage.	We need help from Don, and Todd to move things around.

Building 911B
P.O. Box 5000
Upton, NY 11973-5000
Phone 631 344-4250
Fax 631 344-5954
lessard@bnl.gov

BROOKHAVEN NATIONAL LABORATORY

Managed by Brookhaven Science Associates
for the U.S. Department of Energy

Date: *August 16, 2004*

To: *S. Shchelkunov*

From: *E. Lessard, Chair, BNL Environment, Safety and Health Committee*

Subject: *LESHC 04-04, LACARA Experiment - Approval of Magnet Testing*

Reference: *1. BNL email, S. Shchelkunov to R. Travis, "LESHC 04-04 – LACARA – Status of LESHC Testing Prerequisites", August 11, 2004.*

The Cryogenic Safety Subcommittee of the BNL Laboratory ES&H Committee (LESHC) reviewed the proposed Physics Department LAser driven Cyclotron AutoResonance Accelerator (LACARA) experiment in our meeting of May 12, 2004 (LESHC 04-04). The Minutes and related documentation are posted at: http://www.rhichome.bnl.gov/AGS/Accel/SND/laboratory_environemnt,_safety_and_health_committee.htm.

LACARA consists of two major parts: the laser transportation system and a solenoidal gas cooled magnet. The latter component was the focus of the LESHC meeting.
The magnet will be first tested in the high bay of Building 820. The test cycle (magnet evacuation, cooldown, energization, performance testing, etc.) is expected to require approximately 10 days. After the magnet test period, LACARA will be installed on Accelerator Test Facility Beamline Number 2.

The Minutes contain two Committee Motions. Motion 1 documented nine conditions that were required to be completed prior to the start of LACARA testing. Motion 2 presented additional Committee requirements that must be completed prior to the start of LACARA operations.

Thank you for the recent email transmitting the revised Magnetic Field Exposure Form (Reference 1). Based on our review of this submittal and several field inspections, all outstanding Committee requirements for cooling the magnet have been completed. Approval for cooling the LACARA magnet is granted, subject to the completion of any outstanding Physics Department internal reviews.

When the magnet cooldown phase is completed, the Physics Department will install the 5 Gauss fencing and related signage. When that action is complete, the magnet can be energized and the test cycle can be completed.

Prior to the start of LACARA operations, please contact me (X4250), or Rich Travis (X5827), so that we can verify the completion of the Committee operational prerequisites (from Motion 2) and grant permission to operate.

CC (via Email):
LESHC Members, Meeting Attendees, S. Aronson, M. Bebon, M. Beckman, J. Ellerkamp, L. Hinchliffe (BHSO), T. Kirk, K. Klaus, R. Liegel, S. Musolino, I. Pogorelsky, J. Tarpinian, P. Yerry, M. Zarcone